PRIORITISING THE MOBILISATION OF EMERGENCY MEDICAL SERVICES: PATIENT MAKING AT THE HEALTHCARE GATEWAY

ABSTRACT

Purpose: To analyse the socio-material practices through which organisational understanding of patients is accomplished in order to prioritise calls and mobilise emergency medical services at the gateway of the healthcare system.

Design/methodology/approach: Ethnographic study of the coordination of collective action in an emergency services control room in the Welsh NHS, with data generation and analysis informed by Translational Mobilisation Theory.

Findings: Mobilisation of emergency medical services entails the translation of callers' undifferentiated problems into response priority categories, which are used by dispatch operators to mobilise crews. A central actor in these processes is the computerised Medical Priority Dispatch System. While designed to enable non-clinically qualified call-handlers to triage calls in a standardised way, the system constrains caller-call-handler interaction, which negatively impacts the categorisation process. Analysis of these interactional difficulties and associated mitigation strategies highlights opportunities for intervening to support coordination at this healthcare boundary.

Originality: Orthodox approaches to improving interface management are founded on a conceptualisation of 'patients' as immutable actors in care transfer processes. Translational Mobilisation Theory brings into view the multiple versions of the 'patient' produced by healthcare systems and offers a framework for analysing the mechanisms of action necessary to create organisational understandings of patients at boundary crossings. While the ambulance control centre is a singular case, the paper illustrates the value of attending to these processes in interface organisation.

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"Calling 999 is simple – as it should be. […] What happens next? Someone answers your call. They confirm your address and put you in the system. Ask what's happened. Find out what's wrong. The call is categorised: now you're one of the 'calls holding' – a string of numbers, a coloured dot on a map. You exist – or you will do as soon as we have someone available to send. Now your status depends on the route you've taken through the flowchart; your identity is the result of how closely you match a set of criteria.

Someone else looks at the call and, so long as one's available, an ambulance is dispatched. Sometimes a car, or a bike – if they think the patient will benefit from an early intervention. Very occasionally a helicopter. The crew receives the job. They start making their way."

(Jones, 2020)

INTRODUCTION

The management of patient trajectories through healthcare systems entails navigation of numerous boundaries, the organisation of which has significant implications for quality and safety. A contemporary international policy priority, effective interface management has been the focus of various improvement efforts in recent years

(Catchpole *et al.*, 2007; Kripalani, *et al.,* 2007; Currie and Watterson, 2008; Aase, *et al.,* 2017). Initiatives vary in terms of technologies, strategies and the sites of intervention, but they are united by a common conceptualisation of care transition predicated on the assumption of 'patients' as immutable actors in transfer processes. This framing is evident in the title of the manual - *Passing the Baton* (National Leadership Innovation Agency For Healthcare, 2008) - a practical guide in which the metaphor of the baton handover is used to portray a 'seamless transfer of care':

> 'In a relay race you can't just throw the baton up in the air and hope the next person catches it. You must keep a firm hand on the baton until you are sure the next person catches it' (p. 4).

As I have shown in ethnographic research on the organising work of hospital nurses, (Allen, 2014), for all the policy rhetoric on person-centred approaches, health and social care systems create multiple versions of the patient for specific organisational purposes. The understanding of the patient generated in the Emergency Department, differs from that generated by Operating Theatres, which differs from that generated by the Community Rehabilitation Service. Accordingly, coordination across organisational interfaces involves more than robust handover mechanisms, it also entails the reconfiguration of organisational understanding of the patient from the work object of one service into the work object of another. In my study of nursing work, I referred to this process as 'parsing patients', deploying the notion of parsing as it is used in computer science to refer to the translational processes through which the source code of a computer is analysed before it is turned into machine code, which is the language the computer understands. My primary purpose was to highlight the skills and knowledge that underpin this substantial, but invisible, component of the nursing role and its importance for healthcare quality and safety. However, the

analysis also drew attention to the costs and benefits of the diverse socio-material arrangements through which 'parsing patients' is accomplished at different interfaces, suggesting this framing had wider value for improvement purposes. Attending to the processes through which organisational understandings of the patient are managed at interfaces has the potential to generate new ways of intervening to improve services that go beyond orthodox solutions predicated on assumptions about immutable patients. With this intent, this paper examines the work of ambulance control centre call operators in the Welsh NHS. While the work of nurses was intended to support boundary crossings *within* the health and social care systems, Emergency Medical Services (EMS) call-handers work at the *threshold* of healthcare systems and their work involves the translation of undifferentiated individual troubles into the organisationally relevant objects of practice that are necessary to prioritise the dispatch of EMS services. A central actor in these processes is the computerised Medical Priority Dispatch System (MPDS). While designed to enable non-clinically qualified call-handlers to triage calls in a standardised way, the system constrains the agency of users creating a number of interactional challenges, which impact on the effectiveness of prioritisation and mobilisation process.

BACKGROUND

Pressures on healthcare are growing, and ambulance services are no exception. In Wales between 2016 and 2018 there was an 11.3% increase in demand. The reasons for this are complex but include the impact of an ageing population, social issues such as poverty and social isolation, and a lack of public understanding of local care provision (Mills and Whitehead, 2018). The effectiveness of emergency services also depends on other parts of the health system. In England in 2015-16 around 500,000

ambulance hours were lost because of delayed turnaround times at accident and emergency departments (National Audit Office, 2017). New models of care, which enable calls to be resolved without transport to hospital – such as 'hear and treat', the use of alternative referral pathways, and greater use of advanced paramedics - aim to address these system pressures but services continue to struggle to meet rising demand (Welsh Ambulance Service NHS Trust, 2020; National Audit Office, 2017) and staff sickness and turnover rates are also an on-going concern (Wales Audit Office, 2018; Granter *et al*., 2018).

Formal EMS prioritisation systems were adopted in the UK in 1997. These are computerised expert systems built on abstract universalised rules and algorithms that capture the knowledge required to triage calls in a standardised way. Before this, call handlers would just ask whatever questions they considered relevant to the case, a process that resulted in inconsistency and poor diagnostic accuracy. Since their introduction, formal prioritisation systems have evolved in response to the acknowledged limitations of the technologies, but also to accommodate shifting demand patterns and changes in the organisation and delivery of EMS and unscheduled care (Durham, *et al.,* 2016).

There is an emerging body of social sciences research on EMS work, particularly the work of front line responders. This includes studies of everyday work culture and practice (Hughes 1980; Palmer, 1983; Mannon, 1992; Corman, 2017), aspects of workload and intensity (Granter *et al.,* 2018; Kyed, 2019), professionalization processes (McCann, 2012), inter-occupational working (Tangherlini, 2000; Seim, 2017; Moore, 2020) and the changing institutional role of the service (Seim, 2017, 2020). A small number of studies have specifically examined EMS control centre

work. This includes Pope *et al.*'s (2013) research on the implementation of decision support technology in the English NHS, Greatbatch *et al.*'s (2005) conversation analysis of NHS Direct nurses, and Corman's institutional analysis of an ambulance dispatch centre in Canada (2017). All three studies highlight the failure of rule-based expert systems to capture the range of contingencies that arise in everyday practice and underline the skills deployed by call handlers in working flexibly with and around formal systems, despite the intentions of system architects for standardisation and control. By contrast, the call-handlers considered in this paper were disinclined to deviate from the requirements of the MPDS and had to discipline callers to operate within the constraints of the system.

METHODOLOGY

This paper draws on ethnographic data generated in an EMS control centre as part of a wider research into transfers of care. Using hip fracture as a tracer condition, I studied interface management in a number of sites in a single region: EMS control centre, ambulance crews, Accident and Emergency Department, hospital wards, operating theatres and post anaesthetic recovery, community services and outpatient clinics. While it was not possible to follow individual patients through the system, the approach was designed to mirror a typical patient journey. Data were generated through observation and semi-structured interviews and the analysis of artefacts and documents.

This paper draws on a sub-section of the total dataset and comprises 18 hours of fieldwork in one of the three clinical contact centres in Wales. I shadowed control centre staff - EMS call-handlers (3), a nurse and paramedic who operated the clinical desk, and dispatch operatives (2) - listening to calls through a headset while

simultaneously observing practice and discussing work experiences with participants during breaks in workflow. Observations and conversations were recorded as contemporaneous field notes that captured what was observed and discussed without interpretation, and transcribed after each fieldwork episode. A digitally recorded semi-structured interview was also undertaken with the control centre manager, which generated background information to supplement observations of control centre work.

Ethics approval was received from the NHS Research Ethics Committee [IRAS ID: 94593] and research and development approvals were granted by health, social care and EMS services. All participants were given a study information leaflet and had time to consider participation in the research before giving written consent. Within the wider study, patients and the public gave verbal consent for their care to be observed, but this was not possible for callers to the EMS service. Field notes did not include any information that could identify patients or callers.

Data generation and analysis were informed by Translational Mobilisation Theory (TMT) (Allen and May, 2017; Allen 2018; https://www.translationalmobilisationtheory.org). TMT describes and explains how collective action is progressed in emergent and complex situations. In healthcare, as in a wide range of fields, the classic bureaucratic model of organising is being replaced by more fluid arrangements (Castells, 2009) where order is not determined by formal structures, but materialises from shifting patterns of heterogeneous elements (Law, 1994). As I discovered in my research on the organisational components of nursing practice, we lack readily available theoretical frameworks for understanding collective action of this kind, which makes rigorous case study and comparative analysis difficult. TMT was developed to address this

gap in understanding; it is derived from my study of the organising work of nurses and draws on insights from Normalisation Process Theory (May and Finch, 2009).

TMT is a middle-range theory that explains the relationship between individual actions and goal oriented collective activity. It belongs to a family of approaches known as practice theories (Nicolini, 2012) and connects interactionist perspectives on negotiated social orders (Strauss *et al*., 1964), analyses of sociotechnical networks (Latour, 2005), and theories of strategic action fields (Fligstein & McAdam, 2011). Together these furnish the four domain assumptions of the theory. First, TMT underscores the dynamic qualities of systems of work and the complex inter-relationships between people, materials and technologies. Second, order in organisations is conceptualised as produced through the everyday practices of individuals as they go about their work. Third, TMT highlights the role of artefacts in mediating activity. Artefacts are the means through which participants create and understand the objects of their practice and condition the possibilities for action. This might include material artefacts, such as tools, technologies and instruments, or cognitive artefacts, such as categories, heuristics and methods. Fourth, drawing on insights from Actor Network Theory (ANT) (Latour, 2005), TMT directs attention to how activity is distributed not only between people, but also across materials and technologies.

TMT was adopted as the theoretical framework for the research as it was a good fit with the study's focus on concerted activity and transfers of care at organisational boundaries. The basic unit of analysis in TMT is the 'project', which refers to what is done in collective action. My overall project of interest was the mobilisation of a trajectory of care across a whole health and social care system, however, within this, each interface was conceptualised as a discrete sub-project and data generation and

analysis were focused on the mechanisms of action through which transfers of care were organised and the contextual factors that shaped activity. TMT directs attention to these contextual features through the concept of the 'strategic action field', which furnishes the institutional arrangements and socio-material resources that condition collective action. Accordingly, data generation and analysis focused on the social norms, organising logics, interpretative repertoires, technologies, materials, and structures that shaped interface management, and which were uniquely configured across the interfaces included in the study with diverse impacts on boundary organisation and management. TMT specifies five mechanisms through which projects of collective action are mobilised. These include: object formation (how actors draw on interpretative resources to create objects of practice), reflexive monitoring (how actors evaluate a field of action to generate awareness of project trajectories), articulation work (how the diverse elements comprising projects of collective action are aligned and mobilised), translation (how practice objects are shared and differing viewpoints accommodated), sense-making (how actors deploy interpretative resources to make meaning of a field of practice, order their activity and account for their action). Boundary crossings are highly variable, and within the wider study, these mechanisms were constituted and distributed in different ways at different interfaces. The primary focus of this paper is on the mechanism of object formation in EMS control centre work, that is the processes through which undifferentiated caller concerns are translated into the response priority codes required by dispatch operatives to mobilise the crews, and the socio-material distribution of this function between the MPDS and call-handlers.

All data were transcribed and entered into Computerised Qualitative Data Analysis Software: Atlas/ti. Data were analysed through systematic reading and re-reading and

coded iteratively. The coding frame was informed by, but not limited to TMT, and designed to facilitate an understanding of transfers of care across the interfaces that intersect the whole health and social care system. In this paper, in addition to the overall framing of the study through TMT, I have drawn on insights from science and technology studies to support some of the fine-grained analysis.

PRIORITISING THE MOBILISATION OF EMS

There is variation across the UK in how emergency ambulance calls are managed (Mills and Whitehead, 2018). The mobilisation of emergency services in Wales is based on the Clinical Response Model [www.wales.nhs.uk//easc/ambulance-quality-indicators]. There are three categories of call: Red (immediately life threatening), 'Amber' (serious but not immediately life threatening, but urgent and may need care at the scene), and 'Green' (not serious or life threatening and can often be managed by other health services) (Mills and Whitehead, 2018). The Wales national target for arriving at a red call in eight minutes is 65%.

Management of the EMS gateway is driven by an organising logic designed to ensure resources are deployed according to clinical priority. EMS resources include - rapid response vehicles (RRVs), first responders, advanced paramedic practitioners, emergency medical technicians, and unqualified care assistants (qualified in life support that can back up the rapid response team and usually involved in patient transport). All calls are managed initially by non-clinically qualified call-handlers who work with the MPDS to generate a priority dispatch code. The dispatch code is the object of practice that enables dispatch operatives to allocate appropriate resources. It comprises of four types of information: a number which indicates the specific condition; a letter or symbol which indicates how many crews are needed, the

expertise and how rapidly they are needed for the condition; a number which relates to other aspects of the patient's condition – for example, are they alert, and a fourth component, only present with certain codes which provides additional information about risks at the scene. The emphasis is on getting the right resource to the patient.

> *Dispatch Operative: 'A few years ago […] all that they needed to know was where they were going and why. Anything else was a bonus. Things have changed and now they are concerned with determining the most appropriate response. So the information on what has happened needs to be more detailed'.*

Call handlers and dispatch operatives are supported by a 'clinical desk', run by a nurse and a paramedic, who reflexively monitor calls and 'use their antennae' to determine whether a call has been incorrectly categorised.

> *Control Centre Manager: So what they do is they look at all calls from the red twos, down to the green threes. They don't do it in any particular order; just what they feel is appropriate on the stack.*
>
> *(Interview)*

TMT is concerned with the distribution of collective action between people, materials and technologies and the role of artefacts in mediating activity. This requires consideration of the activity performed by the technology as well as the activities and constraints the technology imposes on users (Latour, 1998). The intent of system developers is that call handlers are able to engage with callers to generate the information required by the MPDS algorithms so that individual's concerns can be automatically translated by the computer into an appropriate response category, to enable dispatch operatives to prioritise the mobilisation of EMS resources. The

analysis will focus on the challenges that call-handlers confront in generating the information required by the MPDS, the impact this had on the generation of response priority categories, and the formal and informal mitigating strategies that were necessary to overcome some of the limitations of the system to articulate collective action at this interface.

MAKING PATIENTS AT THE EMS GATEWAY

CALL HANDLER WORK

As Greatbatch *et al*. (2005) have shown, expert systems are designed to limit the autonomy of users to ensure consistency and lessen risk. Point of contact call-handlers in the study site were not clinically qualified, with many having a background in telesales and customer services. In order to translate callers' concerns into dispatch priorities, the MPDS required call-handlers to ask scripted questions in a predetermined order, and enter the caller information into the system. Call-handlers could not progress through the system until a question had been completed and the data entered. Compliance with these expectations was routinely monitored and in contrast to other research that has evidenced the skills of users in working flexibly around the constraints of expert systems (Greatbatch *et al*., 2005; Pope *et al*., 2013), in this study call-handlers did not operate outside of the technology.

> *CH: We are concerned with basic questions relating to life and death and we can only ask the questions as set out. We can't elaborate […] It's like a bible.*

> *Paramedic: The system is in its infancy and so we are adhering to it to the letter.*

A call begins with the call-handler establishing the location of the emergency and obtaining a contact phone number and then the questions start with a worse case scenario for a symptom in order to quickly identify immediate life threatening emergencies. After ruling out a 'red' categorisation the call handler asks additional questions to determine the priority for dealing with the incident and provide the caller with advice. Once a call is prioritised the call-handler will either end the call, typically leaving a recorded message or, if indicated, they will stay on the line until the ambulance arrives. The MPDS also has instructions for the call handler to support the caller while assistance is en route, including giving potentially life-saving instructions.

The following extract typifies the sequencing of a call; 'CH' is used to denote the caller handler and 'C' to denote the caller throughout the paper.

CH requests address and phone number. […] Once these details are verified CH asks: So can you tell me what happened?

C: My mother is ninety-two and she's had a fall. She's broken her finger but I am more concerned about her back and ribs.

CH: Is she awake?

C: Yes

CH: Is she breathing?

C: Yes

CH: When did this happen?

C: About an hour and half ago

CH: How far did she fall?

C: About four to five feet

CH: Off what?

C: She stood on a chair and fell backwards and struck a radiator

CH: Is she alert?

C: Yes but she suffers with dementia

CH: Is she having any difficulty breathing?

C: No

CH: Is she in pain?

C: Yes

CH: OK well I have organised help and I will tell you what to do. Don't move her. Help is on its way. Listen to the recorded advice.

CH said that this generated a 30 minute response; it is not life threatening.

Call handlers worked to performance targets, which were displayed on large screens above their section. I did not see any direct impact of targets on operator behaviour, but it was clearly an important background feature of their work.

I asked about the time they had available to establish the initial information. This is 30 seconds for the address and 30 for the case entry. […] They also have a call time target of 2-4 minutes and even that can be hard to meet.

CH: You ask what has happened? And when they start with 'Well what it is…', then you know that they are going to be an age then. Some even when you ask for address they just go babbling on!

Expeditious management of the call was necessary in order to obtain the information required by the MPDS to generate a response priority within these performance targets. A major challenge was to achieve an 'institutionally constrained focus to the talk' (Whalen and Zimmerman, 1987) and ensure the caller responded appropriately to all questions so the information could be entered into the system. Call-handlers faced three types of challenge in generating the information required by the MPDS: caller-derived, script-derived and algorithm-derived.

CALLER-DERIVED CHALLENGES

The first category of challenge arises from the characteristics of callers. People who call for emergency assistance display a wide range of states and dispositions - young, old, intoxicated, injured, limited language skills and distress - which may have a bearing on their ability to provide the information necessary for call-handlers to process the call (Cromdal, *et al.*, 2012). In the following example, the caller is very distressed and the call handler must take control of the interaction in order to obtain time critical information and assess whether an emergency response is required. Having listened to the caller's account of the problem and acknowledged her distress, the call-handler moves quickly to an institutionally constrained interactional format explicitly indicating that she is going to 'process the call'.

The next caller is very distressed. The call concerns a patient who has a colostomy 'which is pouring out'. She is apologetic for contacting the

ambulance service, but she has called the GP and has been told that they are on their rounds, 'So who knows when they will get here'.

CH: OK. I know this is very distressing, but I am just going to process the call.

In addition to handling calls from the public, call-handlers managed urgent calls from healthcare professionals, using the same algorithms to process the interaction. Call-handler interactions with healthcare professionals do not feature in previous research and may be a singular feature of the study site, but they were a common source of interactional trouble. One frequently observed difficulty arose from the over-familiarity of healthcare professionals with the information needed by call handlers, but a lack of understanding of the constraints of the MPDS in structuring their work.

CH: Yeah that's one of our main challenges, really ... the healthcare professionals, cos they ring up all the time, basically, and they know what they're going to be asked, but they just want to garble it out ... obviously we've got to ... there's a system ... and they can't deviate from that ... they can't put something in that should be further on in the conversation, as opposed to the start of the conversation, you know?

CH begins to ask questions about whether the patient is breathing or conscious and the caller offers information on whether the patient can travel alone or not. After the call ended CH rolled her eyes and said that 'Some HCPs are hopeless. They are just spitting everything out. I want to say, just let me do my job!'.

SCRIPT-DERIVED CHALLENGES

All technologies are founded on a 'script', that is, assumptions about the context in which they will be deployed. The MPDS presupposes callers will have access to the information required by the system to triage cases and prioritise the call. For a number of reasons, this was often not the case.

Callers regularly were not co-present with the patient. In these circumstances, the call handler might instruct them to move to a position where they can see the patient, or to end the call so the call handler can speak to the patient directly.

> *This call is from a neighbour calling on behalf of a lady who has collapsed in the toilet. She is calling from her own home, and this makes it difficult for her to answer the CH's questions. When CH asks whether she is conscious, the neighbour cannot answer and CH asks if she can put the phone down and go and check for her.*

Calls made by personal alarm services were also challenging. Personal alarm services are designed to help manage the safety of vulnerable people living in their own homes. Users typically wear a pendant alarm, which can be activated in the event of an incident and managed by a remote monitoring team. Alarm service teams frequently contact EMS on behalf of clients, but because they are not co-present find it difficult to answer call-handler's questions.

> *CH said that one of the challenges they had was calls from organisation's like 'Lifeline' […] very often they do not have the information the CH needs. 'If they would only ask a few more questions because when we call the patient they often won't answer'.*

The following example is illustrative:

This is quickly followed by a call from someone who gives their first name and says they are from Lifeline. She reports that she has just taken a call from a confused patient and she provides the telephone number and the address. CH asks what has happened.

C: She's sixty-two and collapsed to the floor. She's not hit her head but is dizzy.

CH: Is she awake?

C: Yes

CH: Is she breathing?

C: Yes

CH: When you say collapse what happened?

C: That was their words; the call has just come through

CH: Do you know what the cause was?

C: I don't know

CH: Is there serious bleeding?

C: No

CH: Are they alert?

C: I spoke to the husband and when I spoke to her she was a bit confused.

There is then a discussion about how to get entry to the home – which the caller is evidently reading from notes on her own system. […] CH terminates this call and rings the patient.

In this particular example, the call handler contacted the patient directly, but she was slightly confused and struggled to furnish the information required.

ALGORITHM-DERIVED CHALLENGES

The final category of interactional challenges is derived from the scripted question and answer format deployed by the MPDS algorithm. As Berg (1997) has shown, expert systems are fundamentally reductionist, because they seek a single answer to what are often complex multifaceted issues and 'impose a formally rational, individualist structure on work that in situ is actually social, affective, [and] hermeneutic' (Greatbatch *et al*., 2005, p. 803). Here Greatbatch *et al.* are highlighting the impact of expert systems on the sense-making mechanisms that are deployed in everyday life to create meaning and order out of uncertainty. The NHS Direct nurses in Greatbatch *et. al*.'s study worked flexibly with the technology to address everyday contingencies, which meant the technology receded into the background in their interaction with callers. In my study, the reluctance of call-handlers to deviate from the MPDS created several kinds of interactional difficulties.

One common issue arose from the tension between the desire of the caller to provide a narrative account of their problem or concern and its significance for them, and the specific and more fragmented information requirements of the MPDS. This tension could often produce a struggle for control of the interaction.

The next call comes from an anxious parent who is incredibly challenging to discipline and seems unable to recognise there is a process the call handler

must work through. CH finds it difficult to get her to comply with the questions and their sequencing. The call relates to a child that has a gastroscopy tube which appears to have blocked off. The caller makes reference to the child gagging and blood coming from the tube as a result of the child straining. The questions actually make it very difficult for the caller to give a full picture of what is happening and so she must disrupt the interaction in order to tell her story which is difficult to fit into the standard questions about breathing, alertness, awake etc.

There is question about bleeding.

CH: Which part of the body is the bleeding from?

C: Where he is straining through the tube, it's not loads. He's been gagging.

CH then asked something about whether the bleeding was serious and the caller said it was 'where he has been straining' adding, 'He's normally got a PEG but this is a temporary wire. I've not put anything down it. I am too scared'.

CH says she is organising help.

C: He's been like this since I gave him his medicine.

[...]

The system indicates that she should be referred to NHS Direct for a more detailed assessment. When CH shares this news with the caller, she is clearly very unhappy.

C: Oh dear! Oh dear! I think you should just come and get him love.

This is a variant of a commonly recognised problem whereby very ordinary forms of talk have to be pressed into the service of more formalised or specialised encounters (Atkinson, 1982). Whereas in face-to-face situations, such as medical clerking, there is some flexibility to negotiate the interactions, the MDPS allows no such flexibility to accommodate caller storytelling.

Further interactional troubles were derived from the sequencing of questions and the information required by the MPDS algorithm. For example, at the beginning of the call, the call handler asks what has happened, and this is then followed by questions about whether the patient is breathing, a question designed to determine whether there is a threat to life which would require a red eight minute response. Depending on the caller's answer to the question of 'what has happened?' the caller could expect the call handler to subsequently infer the answer to the next question – 'is the patient breathing?' - without the need to ask for it. Similarly, if the caller has already offered unsolicited information or has provided it as part of the answer to another question then it is possible that there will be a question in the MPDS sequence, which asks for this information again. In the following example, although the caller has already said that their father has diarrhoea and sickness in response to the question of what has happened, the call handler again asks about nausea and vomiting later in the interaction.

CH: What has happened?

C: My father has got cramp all down his right side and diarrhoea and sickness too.

CH: How old is the patient?

C: Fifty seven

CH: Is he awake and breathing?

C: Yes. One minute he is hot and then cold

CH: Is he alert?

C: Yes

CH: Is he breathing normally?

C: Yes. Kind of….He's got asthma.

CH: Is he having difficulty speaking between breaths?

C: No

CH: Has he changed colour?

C: He's pale

[]

CH: Does he have any nausea or vomiting? ((She's already provided this information))

C: Yes

CH: Has he ever had a heart attack or angina?

Despite the repetition in the above example, the caller is compliant with the call-handler requirements for processing the call, but in this second example, which involves a healthcare professional, the inflexibility of the algorithm produces a number of interactional troubles.

The next call comes from a nurse in 'Resus' in EU who wishes to book an ambulance to transport a patient to the Poisons Unit. The nurse volunteers that the patient has taken a lot of drugs and will be travelling with an Intravenous Infusion in situ. […]

With the nurse having set out the scenario, the question CH asks – 'Is the patient breathing?' – seems odd, as based on the information the nurse has already offered any reasonable person would realise that yes the patient was breathing. Similar interactional difficulties arise when the CH asks:

CH: Is there a defibrillator there?

C: A what? Sorry! (sounds incredulous)

CH: Is there a defibrillator there?

C: ((Laughs)) A defib! Yes! It's A&E!!

These findings contrast with those of Greatbatch *et al*. (2005), who observe that NHS Direct nurses avoid these kinds of interactional difficulties by disregarding algorithmic questions if the caller has already furnished the information in response to an earlier question.

A further interactional problem created by the algorithm stems from the requirement for a definitive answer that callers were either unable or reluctant to provide.

She said that one of the challenges with the system is that the callers have to use particular words and if they don't you can end up with an inappropriate response category.

CH said that this was the fastest kind of response and there are 'hot words' that can trigger this, such as 'gasping'.

In order to determine whether an emergency 'red' response was required for ambulances called by health professionals, the algorithm asks: 'Is there an immediate threat to life?'. In a variant of this category of interactional challenges, healthcare professionals were often reluctant to answer this question, perhaps reflecting concerns with professional accountability. I observed a number of occasions in which the call-handler translated the question so that it furnished the information required by the MPDS, that is, what response time was required, rather than a request for a clinical prognosis.

This call comes from a GP surgery and is made by a nurse. It concerns a patient who has 'new AF' [atrial fibrillation].

CH: Is this an immediate threat to life?

C: It depends on what happens in the next few minutes!

CH: Does this need a eight minute or a thirty minute response? […] breathing, circulation or airway ?compromised

C: 30 minutes

After the call HC observes: 'Some HCPs are hopeless, they won't give you the answer you want'.

MITIGATING STRATEGIES

While call handlers worked hard to process calls within the constraints of the technology there was widespread agreement within the control centre that the MPDS

was a ‘blunt instrument’ which could produce inappropriate response priority categories and impact on EMS mobilisation processes. Formal and informal strategies were in place to mitigate these risks.

The clinical desk was implemented in response to the recommendations of the McClelland Review of the Welsh Ambulance Service (2013) to strengthen triage and prioritisation processes. A nurse and a paramedic reflexively monitored the calls coming into the system once they had been triaged by call handlers and were able to contact callers directly to undertake a more detailed assessment and determine whether the response priority category should be modified. Clinical desk staff used the Manchester Triage System, which was not computerised and which gave them greater latitude to deploy professional judgement in assessing cases compared to the tightly circumscribed algorithms used by call-handlers. Moreover, beyond their additional clinical expertise, because interactions with callers were unconstrained by technology or a standardised script, the nurse and paramedic were able to explain their questions and clarify caller responses in order to gain understanding. Thus, unlike the call-handlers, they were able to utilise their everyday interpersonal interpretative skills to make sense of a case.

While the MPDS did not afford call handlers any latitude to formally deploy their sense-making skills in managing a call, there were other ways in which these insights informed the coordination of EMS services. In addition to the second layer of triage provided by the clinical desk, call handlers would make a ‘warm transfer’ and speak to either the clinical desk or dispatch operatives if they had concerns about the categorisation of a call.

She said that sometimes a case which sounded like meningitis would be put through to NHS Direct but that before this was done she would 'speak to the desk' and say, 'They're not saying, but they have all the symptoms'.

Nurse said that she had had a case earlier this shift in which a woman had taken an overdose of DNP (a diet pill) and she was burning up inside. The system had suggested that she only required a 30-minute response, but she was clearly in a bad way, so she went over and spoke to the dispatch desk.

The sense-making skills of call handlers in detecting inaccurate response categories was recognised by clinical desk staff:

Paramedic: 'They are not clinical and so it is not fair to make judgement calls. But they are very good the call takers. They will come up and say, 'This has come out as a Green 3 – no way!'. So we had an example of an eight-year-old child who was having an allergic reaction and the call handler came across alerting me to their concerns with the category. Otherwise if it's low on the stacks – say Green 3 – then you may be three pages back and not necessarily triaged. […] I had a code, which was a child who was very short of breath and had pruritus – they were itching for Wales – and they could still feel the peanut in the back of their throat. There was an APP (Advanced Paramedic Practitioner) around the corner and the first thing they did was to bang them full of adrenalin. And in the words of the APP if the call handler hadn't looked at this then the child would have been dead. He owes his life to a proactive call handler. We all have to work together.

Despite these additional interventions within the control centre to improve the adequacy of response categories, ambulance crews were very critical of the quality of

the information generated by the system, with particular concerns expressed about calls being prioritised as more urgent than they considered them to be, with knock on effects for EMS capacity to respond to Amber calls. The following extract from field notes generated when shadowing ambulance crews has all the hallmarks of an apocryphal tale, but nevertheless highlights crews' frustrations with the limitations of the call handling system.

> *Paramedic: What you will notice is that if you take note of what comes through and then what the patient says it is often way off the mark. I went in to a young man with chest pain, who said that he called about a headache and he said 'They asked me if I had chest pain and I did, two weeks ago'. Similarly we went into a guy who had called NHS Direct about a tooth abscess and they started questioning him and asking him if he pain in his jaw. Which he did, but he stressed that he was not having a heart attack and did not need an ambulance, but because he said he had pain his jaw he got a hot response.*

DISCUSSION

In this paper I have built on earlier research to show that organisational understandings of 'patients' are transformed at service interfaces. Analysis of the mechanisms of action by which such understandings are achieved, and the effectiveness of these practices, can offer new insights into the management of boundary crossings. Informed by TMT and drawing on additional insights from science and technology studies, I have examined the ensemble of socio-material practices through which caller's concerns are translated into dispatch response priorities in order to mobilise EMS resources. The MPDS is a central actor in these

processes, but the interactional troubles caused by the constraints of the technology produced response categories that were often inadequate objects of practice for dispatch operatives and necessitated additional formal and informal reflexive monitoring and sense-making mitigating strategies to strengthen the system. Analysis of the source of these translational troubles opens up a space in which to consider opportunities for improvement interventions.

That callers from the general public are distressed is an unavoidable feature of EMS work which call-handlers are trained to manage. The management of interactional struggles with healthcare professionals is perhaps more challenging, not least because of the underlying power imbalance created because call handlers are not clinically qualified. These findings suggest the need for alternative processes for managing healthcare professional interaction with the service; either through the introduction of a different management system or modifications to allow greater flexibility in handling health professional referrals. There may also be value in engagement and training of health professionals on call handler work. Data from the wider study showed call-handlers' work was poorly understood within the wider health and social care community.

Script-derived challenges that arise because callers do not have the information required by the system are not entirely avoidable, but could similarly be mitigated by further training for health and social care professionals and monitoring services, and public information and engagement campaigns. Here again, however, greater flexibility is required in the MPDS system to enable the timely management of information gaps.

There are, however, a number of other interactional challenges that arise not from the

nature of EMS work, or the scripts on which the MPDS is founded, but from the impact of MPDS algorithms in the interaction and the fact that call handlers felt unable to workaround the constraints of the system. Vigilant call-handlers who worked outside the system to make 'warm referrals' and profession-led triage at the clinical desk, helped to mitigate these effects, but from the perspective of crews on the road, call categorisation remained problematic. Focus groups with control centre operatives carried out as part of an external review of the service undertaken shortly after the cessation of my fieldwork (Mills and Whitehead, 2018) confirmed my findings. One proposal surfaced in the report on the Welsh Ambulance Service (Mills and Whitehead, 2018), was for greater use of clinically qualified staff in control centres working with systems that allow greater scope for professional judgement to triage calls once a call is coded as not immediately life threatening. An advantage of this model is that it would release pressures on call-handlers who, in addition to processing calls, also provide on-going support for callers until ambulance crews arrive. The proposal clearly has resource implications, as it requires increased numbers of clinically qualified and more expensive staff. Furthermore, it does nothing to address the major complaint of crews, that a large volume of calls are over-prioritised, because resources are likely to have already been dispatched before further triage is undertaken. An alternative model, which is evident in previous research in this field, would be to review the questions within the algorithm that are designed to establish whether a call is immediately life-threatening, afford call-handlers greater flexibility in working with and around the expert systems, and provide call handlers with additional clinical training. Here mathematical modelling may have value in assessing the impacts on call-processing time and the accuracy of response priority categories of modifications to the system to allow more latitude for

use of call-handler sense-making skills. System adaption may also improve call handlers' experience of work. EMS control centre operatives are known to experience work-related stress (Golding, *et al.*, 2007), particularly those who work with strict scripts and cannot make full use of their skills experience (Sprigg and Jackson, 2006).

CONCLUSION

In this paper I have deployed TMT and insights from science and technology studies to analyse the ensemble of socio-material practices through which ambulance control centre staff create the objects of practice that enable dispatch operators to mobilise EMS resources according to clinical priority. The MPDS is a central actor in translating the undifferentiated concerns of individual callers into response priority categories. Expert systems, like the MPDS, are designed to limit the autonomy of users to ensure consistency and lessen risk and are an increasingly attractive option in the context of fiscal constraint as it enables work to be undertaken by low-skilled workers. In this paper I have highlighted the challenges call handlers experience working with the technology, the constraints on call-handler sense-making, and how the socio-material organisation of call centre work could be reconfigured to mitigate these risks. The analysis shows how attending to the mechanisms through which organisational understandings of the patient are managed at healthcare interfaces has the potential to generate new ways of intervening to improve service processes that go beyond orthodox solutions predicated on assumptions about immutable patients.

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